



U.S. ARMY
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Cybernetic Models in Multisensory
Integration & Perception

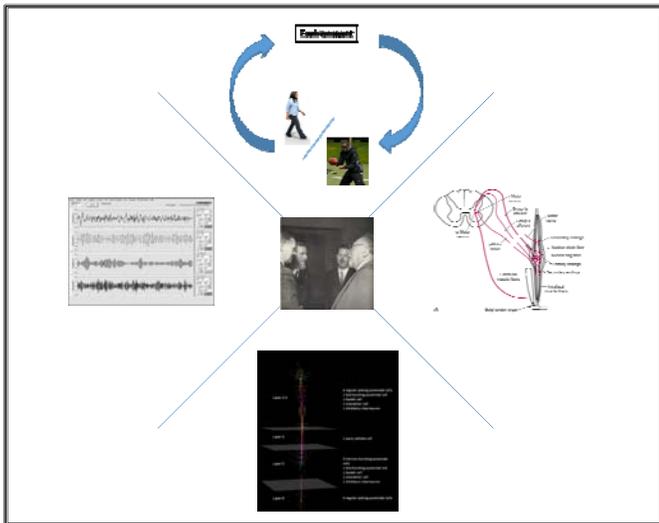


S&T Campaign: Human Sciences Integration of Humans and Systems

Kelvin S. Oie, (410) 278-5960
kelvin.s.oie.civ@mail.mil

Research Objective

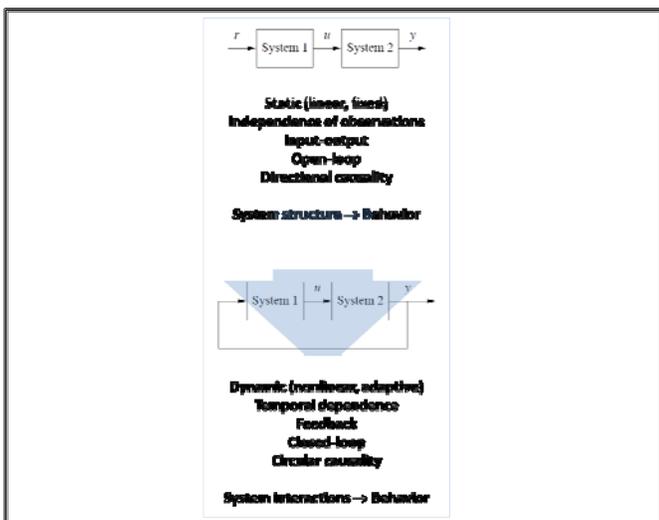
- Develop cybernetic models of human, multisensory closed-loop behavior and identify general principles of organization and function to enhance adaptive behavior human-system interactions



Exploring human behavior and models of dynamic feedback control systems at different levels of analysis

Challenges

- Human cybernetic systems are complex, comprising multiple subsystems with multiple feedback loops
- Conceptualizing cybernetic systems whose behavior reflects multiple timescale processes
- Theory of adaptive behavior is lacking



The cybernetic perspective accounts for the dynamic, closed-loop, goal-directed, and adaptive nature of human behavior in ways current human sciences approaches do not.

ARL Facilities and Capabilities Available to Support Collaborative Research

- Available Facilities (APG, MD)
 - Multisensory augmented reality testbed platform
 - Wearable, head-mounted
 - Highly immersive
 - Flexible, reconfigurable sensor arrays
 - High-resolution, wide field, stereoscopic visual displays
 - Embedded eye tracking capabilities
 - Depth sensing, including hand and finger tracking
 - High performance computing capabilities
 - Local GPU and Xeon Phi platforms
 - Access to DoD supercomputing capabilities
 - GENESIS neural model implementation
 - Multi-aspect real-world measurement capabilities
 - Wearable, un-tethered operation
 - Flexible, fully customizable user interface
 - Multiple modalities: EEG, EKG, EDA, respiration, blood pressure, motion, posture, and others
 - Unique ARL expertise includes:
 - Computational modeling in the GENESIS platform
 - Adaptive mechanisms in multisensory integration and perception
 - Real-world experimental design and analysis

Complementary Expertise/ Facilities/ Capabilities Sought in Collaboration

- Additional expertise needed in:
 - Computational and statistical modeling of adaptive and neural systems
 - Systems and adaptive control theory modeling of human and biological systems behavior
 - Algorithm development and software implementation
- New research approaches sought in:
 - Innovative experimental tasks and paradigms to probe adaptive processes in human multisensory integration and human-system control interactions
 - Mathematical and computational approaches and measures for characterizing and modeling complex cybernetic systems with multiple timescales